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10/615,744	07/09/2003	Yi-Lung Cheng	TS00-268	1840

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EXAMINER
ESTRADA, MICHELLE

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 07/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/615,744

Applicant(s)

CHENG ET AL.

Examiner

Michelle Estrada

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-53 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-53 is/are rejected.
- 7) ☒ Claim(s) 12,13,30,31,46 and 47 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |  |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)            |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>10/14/03</u> . | 6) <input type="checkbox"/> Other: ____  |

## **DETAILED ACTION**

### ***Claim Objections***

Claims 12, 13, 30, 31, 46 and 47 are objected to because of the following informalities: It is not clear what is recited through use of "THK U%", "WIW", "D/E" and "%F%U". Appropriate correction is required.

### ***Double Patenting***

Applicant is advised that should claim 4 be found allowable, claim 20 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-17, 20-31, 33-35, 38-47 and 49-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Zhang et al. (6,468,927) and Barnes et al. (6,521,546).

Re claim 1, Zhang et al. disclose providing a structure; and forming an FSG film over the structure by and HDP-CVD process under the following conditions (Col. 2, lines 28-30 and Col. 4, line 34): no Argon (Ar)-side sputter; an  $\text{SiF}_4$  flow from about 50-65 sccm (Table 1), which overlaps with the recited range of claim 1 (See MPEP 2144.05 and 2131.03); an  $\text{N}_2$  flow from about 20 to 40 sccm (Col. 2, lines 63-65), which overlaps with the recited range in claim 1 and an RF power to provide a uniform plasma density.

Re claim 3, Zhang et al. disclose wherein  $\text{SiF}_4$  flow from about 50-65 sccm (Table 1), which overlaps with the recited in claim 3 (See MPEP 2144.05 and 2131.03); an  $\text{N}_2$  flow from about 20 to 40 sccm (Col. 2, lines 63-65) which overlaps with the recited in claim 3.

Re claim 6, Zhang et al. disclose wherein the FSG film is formed over the structure under the following additional conditions: an Ar top sputter of from about 4 to 6 sccm (Table 1), which overlaps the recited range of claim 6 (See MPEP 2144.05 and 2131.03); an  $\text{SiH}_4$  flow-side or from about 39 to 49 sccm (Table 1), which overlaps the recited range of claim 6; and  $\text{SiH}_4$  flow –top of from about 0 to 10 sccm (Table 1), which overlaps the recited range of claim 6; and  $\text{O}_2$  flow of from about 120 to 150 sccm (Table 1), which overlaps the recited range of claim 6.

Re claim 7, Zhang et al. disclose wherein the FSG film is formed over the structure under the following additional conditions: an Ar top sputter of from about 4 to

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6 sccm (Table 1), which overlaps the recited range of claim 7 (See MPEP 2144.05 and 2131.03); an  $\text{SiH}_4$  flow-side or from about 39 to 49 sccm (Table 1), which overlaps the recited range of claim 7; and  $\text{SiH}_4$  flow –top of from about 0 to 10 sccm (Table 1), which overlaps the recited range of claim 7; and  $\text{O}_2$  flow of from about 120 to 150 sccm (Table 1), which overlaps the recited range of claim 7.

Re claim 14, since the process of the reference meets all limitations on claim 1, it is inherent that the formed FSG film does not form appreciable Si-OH bonds within about a week of formation.

Re claim 15, Zhang et al. disclose wherein the fluorine within the formed FSG film does not appreciably outgas from the formed FSG film (Col. 16, lines 42-44).

Re claim 16, Zhang et al. disclose including the step of forming at least two adjacent metal structure (612) upon the structure before the formation of the FSG film.

Re claim 17, Zhang et al. disclose including the step of forming at least two adjacent metal structures upon the structure and the FSG film is formed over the at least two adjacent metal structures; wherein the at least two adjacent metal structures include corner and wherein the corners of the at least two adjacent metal structures are not clipped by the deposition of the FSG film (See fig. 5).

Zhang et al. do not disclose wherein the substrate structure is comprised of silicon.

Re claims 2, 21 and 39, Barnes et al. disclose forming an FSG layer by a HDP-CVD process (Col. 4, lines 30-35) in a silicon substrate (300).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Zhang et al. and Barnes et al. to enable the substrate formation step of Zhang et al. to be performed according to the teachings of Barnes et al. because one of ordinary skill in the art would have been motivated to look to alternative suitable methods of performing the disclosed substrate formation step of Zhang et al. and art recognized suitability for an intended purpose has been recognized to be motivation to combine. See MPEP 2144.07.

Re claims 4, 5, 20, 23 and 38 one of ordinary skill in the art would have been led to the recited RF power through routine experimentation to achieve a desired plasma density in view of the range of values disclosed.

Re claims 8, 9, 26, 27, 42 and 43, one of ordinary skill in the art would have been led to the recited FSG characteristics through routine experimentation to achieve a desired FSG layer in view of the range of values disclosed and these characteristics depend on the values of parameters that are optimizable such as reactants involved in the process, flow rates of said reactants, flow rate of the N<sub>2</sub> gas.

Re claims 10, 11, 28, 29, 44 and 45, one of ordinary skill in the art would have been led to the recited gap filling ability through routine experimentation to achieve a desired rate of filling depending on the width of the gaps being filled in view of the range of values disclosed.

Re claims 12, 13, 30, 31, 46 and 47, one of ordinary skill in the art would have been led to the recited FSG characteristics through routine experimentation to achieve the desired FSG layer in view of the range of values disclosed and these characteristics

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depend on the values of parameters that are optimizable such as reactants involved in the process, flow rates of said reactants, flow rate of the N<sub>2</sub> gas.

In addition, the selection of a RF power, FSG characteristics, gap filling ability, its obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and In re Aller, 105 USPQ 233 (CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).

Note that the specification contains no disclosure of either the critical nature of the claimed RF power, FSG characteristics, gap filling ability or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen RF power, FSG characteristics, gap filling ability or upon another variable recited in a claim, the Applicant must show that the chosen RF power, FSG characteristics, gap filling ability are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Re claim 22, Zhang et al. disclose wherein  $\text{SiF}_4$  flow from about 50-65 sccm (Table 1), which overlaps with the recited in claim 22; an  $\text{N}_2$  flow from about 20 to 40 sccm (Col. 2, lines 63-65) which overlaps with the recited in claim 22.

Re claims 24, 40 and 41, Zhang et al. disclose wherein the FSG film is formed over the structure under the following additional conditions: an Ar top sputter of from about 4 to 6 sccm (Table 1), which overlaps the recited range of claim 24; an  $\text{SiH}_4$  flow-side or from about 39 to 49 sccm (Table 1), which overlaps the recited range of claim 24; and  $\text{SiH}_4$  flow –top of from about 0 to 10 sccm (Table 1), which overlaps the recited range of claim 24; and  $\text{O}_2$  flow of from about 120 to 150 sccm (Table 1), which overlaps the recited range of claim 24.

Re claim 25, Zhang et al. disclose wherein the FSG film is formed over the structure under the following additional conditions: an Ar top sputter of from about 4 to 6 sccm (Table 1), which overlaps the recited range of claim 25; an  $\text{SiH}_4$  flow-side or from about 39 to 49 sccm (Table 1), which overlaps the recited range of claim 25; and  $\text{SiH}_4$  flow –top of from about 0 to 10 sccm (Table 1), which overlaps the recited range of claim 25; and  $\text{O}_2$  flow of from about 120 to 150 sccm (Table 1), which overlaps the recited range of claim 25.

Re claims 32 and 48, since the process of the combination meets all limitations on claim 20, it is obvious that the formed FSG film does not form appreciable Si-OH bonds within about a week of formation.

Re claims 33 and 49, Zhang et al. disclose wherein the fluorine within the formed FSG film does not appreciably outgas from the formed FSG film (Col. 16, lines 42-44).



Re claims 34 and 50, Zhang et al. disclose including the step of forming at least two adjacent metal structures (612) upon the structure before the formation of the FSG film.

Re claims 35 and 51, Zhang et al. disclose including the step of forming at least two adjacent metal structures upon the structure and the FSG film is formed over the at least two adjacent metal structures; wherein the at least two adjacent metal structures include corner and wherein the corners of the at least two adjacent metal structures are not clipped by the deposition of the FSG film (See fig. 5).

Claims 18, 19, 36, 37, 52 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Zhang et al. and Barnes et al. as applied to claims 1-17, 20-31, 33-35, 38-47 and 49-51 above, and further in view of Lee (6,008,120).

The combination of Zhang et al. and Barnes et al. does not disclose wherein the two adjacent metal structures comprise copper, aluminum or gold.

Re claims 18, 19, 36, 37, 52 and 53, Lee discloses a silicon substrate (21') having a patterned conductive layer (22') and forming a FSG layer (24') over the at least two adjacent metal structures (22') (See fig. 2A); wherein patterned conductive layer comprises aluminum, tungsten or copper (Col. 4, lines 51-60).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Zhang et al., Barnes et al. and Lee to enable the metal structures material of Zhang et al. and Barnes et al. to be the one according to the teachings of Lee because one of ordinary skill in the art would have been the motivated to look to

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alternative suitable methods of choosing the disclosed metal structures material of Zhang et al. and art recognized suitability for an intended purpose has been recognized to be motivation to combine. See MPEP 2144.07.

### ***Conclusion***

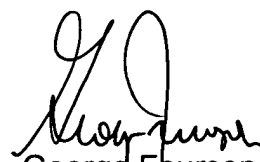
The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michelle Estrada whose telephone number is 571-272-1858. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 571-272-2800.

  
MEstrada  
July 7, 2004

  
George Fburson  
Primary Examiner  
Art Unit 2823